PATENT COOPERATION TREATY

PCT

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference FNTYA036WO	**FOR FURTHER ACTION**	See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)
International application No. PCT/JP2004/019787	International filing date *(day/month/year)* 24.12.2004	Priority date *(day/month/year)* 26.12.2003
International Patent Classification (IPC) or both national classification and IPC INV. H01M8/02 H01M8/24 H01M8/04		
Applicant TOYOTA JIDOSHA KABUSHIKI KAISHA		

1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.

2. This REPORT consists of a total of 6 sheets, including this cover sheet.

   ☐ This report is also accompanied by ANNEXES, i.e. sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

   These annexes consist of a total of 7 sheets.

3. This report contains indications relating to the following items:

   - I ☒ Basis of the opinion
   - II ☐ Priority
   - III ☐ Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
   - IV ☐ Lack of unity of invention
   - V ☒ Reasoned statement under Rule 66.2(a)(ii) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
   - VI ☐ Certain documents cited
   - VII ☐ Certain defects in the international application
   - VIII ☐ Certain observations on the international application

Date of submission of the demand	Date of completion of this report
25.04.2006	11.09.2006
Name and mailing address of the international preliminary examining authority: European Patent Office - P.B. 5818 Patentlaan 2 NL-2280 HV Rijswijk - Pays Bas Tel. +31 70 340 - 2040 Tx: 31 651 epo nl Fax: +31 70 340 - 3016	Authorized Officer Crottaz, Olivier Telephone No. +31 70 340-8994

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No. PCT/JP2004/019787

I. Basis of the report

1. With regard to the **elements** of the international application *(Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report since they do not contain amendments (Rules 70.16 and 70.17))*:

Description, Pages

1-43 as originally filed

Claims, Numbers

1-22 filed with telefax on 25.04.2006

Drawings, Sheets

1/16-16/16 as originally filed

2. With regard to the **language**, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.

   These elements were available or furnished to this Authority in the following language: , which is:

   ☐ the language of a translation furnished for the purposes of the international search (under Rule 23.1(b)).

   ☐ the language of publication of the international application (under Rule 48.3(b)).

   ☐ the language of a translation furnished for the purposes of international preliminary examination (under Rule 55.2 and/or 55.3).

3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

   ☐ contained in the international application in written form.

   ☐ filed together with the international application in computer readable form.

   ☐ furnished subsequently to this Authority in written form.

   ☐ furnished subsequently to this Authority in computer readable form.

   ☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.

   ☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

4. The amendments have resulted in the cancellation of:

   ☐ the description, pages:

   ☐ the claims, Nos.:

   ☐ the drawings, sheets:

5. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed (Rule 70.2(c)).

   (Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report.)

6. Additional observations, if necessary:

V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Yes:	Claims	1-12,14,20-22
	No:	Claims	13, 15-19
Inventive step (IS)	Yes:	Claims	1-12,14,20-22
	No:	Claims	13, 15-19
Industrial applicability (IA)	Yes:	Claims	1-22
	No:	Claims	

2. Citations and explanations

   see separate sheet

Re Item V

Reasoned statement with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Reference is made to the following documents:

D2: EP-A-0 110 517 (ENGELHARD CORPORATION) 13 June 1984 (1984-06-13)

D3: US-B1-6 610 435 (MARUYAMA TERUO ET AL) 26 August 2003 (2003-08-26)

D4: PATENT ABSTRACTS OF JAPAN vol. 2002, no. 09, 4 September 2002 (2002-09-04) & JP 2002 151112 A (NISSAN MOTOR CO LTD), 24 May 2002 (2002-05-24)

D6: US-B1-6 316 137 (KRALICK) 13 November 2001 (2001-11-13)

The document D6 was not cited in the international search report. A copy of the document is appended hereto.

2. Novelty and Inventive Step

2.1 The present application does not meet the criteria of Article 33(1) PCT, because the subject-matter of claims 13 and 15-19 is not new in the sense of Article 33(2) PCT.

2.2 The document D2 discloses (the references in parentheses applying to this document) a fuel cell a layered body of multiple fuel cells having a coolant sealing layer (44), which prevents leakage of a coolant from a coolant conduit formed between adhesion faces of each pair of adjoining fuel cells (31, 42). Although this is not explicitly disclosed in D2 it is known to the person skilled in the art that when the fuel cell has to be dismantled the operator will remove the coolant by dismounting the coolant circuit. This effectively replaces the coolant in the coolant conduit by air. This can be considered as a coolant removal step of supplying a fluid to the coolant conduit to remove at least part of the coolant from a space between the adhesion faces of each pair of adjoining fuel cells.

The subject-matter of claim 13 is therefore not new on the basis of D2.

2.3 The attention of the applicant is also drawn to the fact that it is common practice to supply a fluid (other than air) in the coolant circuit to remove the coolant before disassembling the fuel cell (see for example D6, col. 6, l. 59-col. 7, l. 22).

2.4 The document D3 discloses (the references in parentheses applying to this document) a fuel cell comprising an electrode assembly having an electrolyte (4) interposed between a pair of electrodes (5, 6), sealing layers (7) located to surround periphery of the electrode assembly; and a pair of separators (1A-1C) arranged across the electrode assembly and bonded to the sealing layers, where one of the separators facing one of the electrodes has a fuel gas conduit, while the other of the separators facing the other of the electrodes has an oxidizing gas conduit. The boundaries between the sealing layers and the separators and the boundaries between the sealing layers and the electrode assembly are made of a functional material (an epoxy resin, see col. 6, ll. 29-44) having an adhesion force that will be lowered by a fluid supply for disassembly of said fuel cell, which is different from a fluid supply for power generation of said fuel cell.

The subject-matter of claims 15-19 is therefore not new on the basis of D3.

2.5 The document D4 is regarded as being the closest prior art to the subject-matter of claim 1, and shows (the references in parentheses applying to this document) a fuel cell disassembly method where the disassembly is done by pulling out the linear member (1) located between the sealing layers (23, 25).
The subject-matter of claim 1 differs from this known from D1 in that the disassembly method comprises the step of supplying a fluid to heighten the in-passage pressure or to lower the adhesive force of the sealing layer. The subject-matter of claim 20 is therefore new (Article 33(2) PCT).

The problem to be solved by the present invention may be regarded as to provide a fuel cell allowing disassembly without the risk to damage the electrolyte.

The solution to this problem proposed in claim 1 of the present application is considered as involving an inventive step (Article 33(3) PCT) because it is neither suggested in the prior art, nor is it common knowledge.

2.6 The document D4 is regarded as being the closest prior art to the subject-matter of claim 20, and shows (the references in parentheses applying to this document) a fuel cell having a solid polymer electrolyte membrane (1) drawn out off the sealing materials (23, 25), thus allowing facilitated disassembling of the fuel cell. The subject-matter of claim 20 differs from this known from D4 in that a breaking guide is formed in the separators. The

subject-matter of claim 20 is therefore new (Article 33(2) PCT).

The problem to be solved by the present invention may be regarded as to provide a fuel cell allowing disassembly without the risk to damage the electrolyte.

The solution to this problem proposed in claim 20 of the present application is considered as involving an inventive step (Article 33(3) PCT) because it is not suggested in the prior art, nor is it common knowledge.

2.7 Claims 2-12 are dependent on claim 1 and as such also meet the requirements of the PCT with respect to novelty and inventive step.

2.8 The reasoning indicated in point 2.4 also applies to dependent claim 14, which therefore also meet the requirements of the PCT with respect to novelty and inventive step.

2.9 Claims 21 and 22 are dependent on claim 20 and as such also meet the requirements of the PCT with respect to novelty and inventive step.

CLAIMS

1. (Amended) A fuel cell disassembly method of disassembling a fuel cell, the fuel cell comprising: an electrode assembly having an electrolyte interposed between a pair of electrodes; sealing layers located to surround periphery of the electrode assembly; and a pair of separators arranged across the electrode assembly and bonded to the sealing layers, where one of the separators facing one of the electrodes has a fuel gas conduit, while the other of the separators facing the other of the electrodes has an oxidizing gas conduit,

said fuel cell disassembly method comprising the step of:

supplying a specific fluid (which is referred to as a fluid supply for disassembly of the fuel cell) to at least one of the oxidizing gas conduit and the fuel gas conduit to facilitate separation of the electrode assembly from the pair of separators, where the specific fluid is supplied to heighten an in-passage pressure of at least one of the oxidizing gas conduit and the fuel gas conduit over a level of in-passage pressure level during power generation by the fuel cell or otherwise the specific fluid has a function of lowering an adhesive force of the sealing layers.

2. (Amended) A fuel cell disassembly method in accordance with claim 1, wherein the specific fluid having the function

of lowering the adhesive force of the sealing layers is different from a fluid supplied for power generation of the fuel cell.

3. (Amended) A fuel cell disassembly method in accordance with claim 1, wherein the fluid supply for disassembly of the fuel cell is carried out to supply a fluid to both of the fuel gas conduit and the oxidizing gas conduit.

4. (Canceled)

5. A fuel cell disassembly method in accordance with claim 1, wherein the separator is kept pressing or surrounded during the fluid supply for disassembly of the fuel cell.

6-7 (Canceled)

8. (Amended) A fuel cell disassembly method in accordance with claim 1, wherein the specific fluid having the function of lowering the adhesive force of the sealing layers is either water or an organic solvent, which is different from a fluid supplied for power generation of the fuel cell.

9. (Amended) A fuel cell disassembly method in accordance with claim 1, wherein the specific fluid having the function of lowering the adhesive force of the sealing layers has a higher temperature than a temperature of a fluid supplied for power generation of the fuel cell

10. A fuel cell disassembly method in accordance with claim 1, wherein an external force is additionally applied in directions of parting the pair of separators from each other during the fluid supply for disassembly of the fuel cell.

11. A fuel cell disassembly method in accordance with claim 1, said fuel cell disassembly method further comprising the step of:

weakening a pressing force applied in a direction of making the pair of separators approach to each other during power generation of the fuel cell, prior to said step of providing the fluid supply for disassembly of the fuel cell.

12. A fuel cell disassembly method in accordance with claim 1, wherein said fluid supplying step supplies the specific fluid to facilitate separation of the electrode assembly from the pair of separators included in either a fuel cell stack or a fuel cell module, which is a layered body of plurality of the fuel cells.

13. (Amended) A fuel cell disassembly method that disassembles a layered body of multiple fuel cells having a coolant sealing layer, which prevents leakage of a coolant from a coolant conduit formed either between adhesion faces of each pair of adjoining fuel cells or between adhesion faces of each fuel cell and each coolant conduit separator,

said fuel cell disassembly method comprising:

a coolant removal step of supplying a fluid to the coolant conduit in the course of disassembly of the fuel cells of the layered body to remove at least part of the coolant from a space between the adhesion faces of each pair of adjoining fuel cells or from a space between the adhesion forces of each fuel cell and each coolant conduit separator.

14. (Amended) A fuel cell disassembly method in accordance with claim 13, said fuel cell disassembly method further comprising a fluid supplying step after said coolant removal step,

wherein an oxidizing gas conduit and a fuel gas conduit are formed in the layered body of the fuel cells,

said fluid supplying step supplying a specific fluid to at least one of the oxidizing gas conduit and the fuel gas conduit formed in the layered body of the fuel cells to facilitate disassembly of at least part of the fuel cells of the layered body, where the specific fluid is supplied to heighten an in-passage pressure of at least one of the oxidizing gas conduit and the fuel gas conduit for disassembly of the fuel cells of the layered body over a level of in-passage pressure during power generation by the layered body of the fuel cells or otherwise the specific fluid has a function of lowering an adhesive force of the coolant sealing layer.

15. (Amended) A fuel cell that generates electric power through reaction of a fuel gas with an oxidizing gas, said fuel cell comprising:

an electrode assembly having an electrolyte interposed between a pair of electrodes;

sealing layers located to surround periphery of the electrode assembly; and

a pair of separators arranged across the electrode assembly and bonded to the sealing layers, where one of the

separators facing one of the electrodes has a fuel gas conduit, while the other of the separators facing the other of the electrodes has an oxidizing gas conduit,

wherein at least either boundaries between the sealing layers and the separators or boundaries between the sealing layers and the electrode assembly are made of a functional material having an adhesion force that is lowered by a fluid supply to at least one of the fuel gas conduit and the oxidizing gas conduit for disassembly of said fuel cell, which is different from a fluid supply for power generation of said fuel cell.

16. A fuel cell in accordance with claim 15, wherein the functional material has a characteristic of lowering the adhesion force in a preset high temperature range.

17. A fuel cell in accordance with claim 15, wherein the functional material has a characteristic of lowering the adhesion force, when being exposed to hot water.

18. A fuel cell in accordance with claim 15, wherein the functional material has a characteristic of lowering the adhesion force, when being exposed to either of an organic solvent or a release agent.

19. A fuel cell in accordance with claim 15, wherein the sealing layers are made of the functional material.

20. (Amended) A fuel cell that generates electric power through reaction of a fuel gas with an oxidizing gas, said fuel cell comprising:

an electrode assembly having an electrolyte interposed between a pair of electrodes;

sealing layers located to surround periphery of the electrode assembly;

a pair of separators arranged across the electrode assembly and bonded to the sealing layers, where one of the separators facing one of the electrodes has a fuel gas conduit, while the other of the separators facing the other of the electrodes has an oxidizing gas conduit; and

a breaking guide that is formed in each of the separators to function as a starting point of breakage of the separator triggered by a fluid supply for disassembly of said fuel cell to supply a fluid to at least one of the fuel gas conduit and the oxidizing gas conduit to heighten an in-passage pressure of at least one of the oxidizing gas conduit and the fuel gas conduit over a level of in-passage pressure level during power generation by the fuel cell.

21. A fuel cell in accordance with claim 20, wherein the breaking guide is formed in each of the separators to function as a starting point of breakage of the separator triggered by the fluid supply for disassembly of said fuel cell, which is different from a fluid supply for power generation of said fuel cell, to supply a fluid to at least one of the fuel gas conduit and the oxidizing gas conduit.

22. A fuel cell in accordance with claim 20, wherein the fluid supply for disassembly of the fuel cell supplies either

water or an organic solvent.